

INFORMATION AND COMMUNICATION TECHNOLOGIES IN EDUCATIONAL MANAGEMENT: THE MISSING LINK IN DEVELOPING COUNTRIES¹

Abstract

Being the largest producer of technical and professional manpower, India is an active participant in the development and use of information and communication technologies. Despite this, the education sector is deprived of the benefits of ICTs. The analysis shows that the ICTs offer vast potential for their use in educational management. There have been some developments in the recent past but the major challenge is yet to be met. It calls for a clear policy perspective and a strategy for the development of ITC related applications to be followed by a variety of programmes for capacity building at various levels. The ICTs will succeed only if the administration is positive and inclined to follow norm based planning and management techniques. While every effort should be made to promote the use of ICTs, care should be taken that the benefits of these efforts do not remain confined to a few.

¹ Prepared by Yash Aggarwal, Senior Fellow and Head, Operations Research and Systems Management Unit, National Institute of Educational Planning and Administration, 17-B Aurobindo Marg, New Delhi 110070.

1. THE INFORMATION AND COMMUNICATION TECHNOLOGY

Historically, India was deprived of the benefits of the great industrial revolution². The world is now at the threshold of the next revolution, this time it is in information and communication technologies (ICTs)³. The recent developments in new ways to capture, store, process, transport and display information are having profound impact on the way the societies are organised. These capabilities are reliable, inexpensive and present vast potential for networking and sharing of information in digital form across national and international boundaries. These features combined with advanced telecommunications have created unprecedented kind of infrastructure often called cyberspace and information highways. Established networks like Internet, attract a broadening base of participants, and they interconnect nationally and globally through information highways (Hamelink, 1997). It is postulated that the long-term impact of the ICTs on the social and economic scene of the world communities will be far more stronger and deeper than ever before.

From ICT revolution emerges a new kind of economy - the information economy - in which information is the critical resource and the basis for technological advancement, competition and governance. Old ways of governance are being challenged and sometimes reformulated. Some governments have gone to the extent that certain international transactions will be handled only in the electronic form. Electronic commerce (e-com) transgressing all national and international boundaries is emerging as a new form of economic activity, even though some developing countries are not fully prepared for this. Information technology and telecommunications in developing countries can transform old challenges and create unprecedented possibilities for sustainable economic development, just as it did for business and the industrial world during the industrial revolution. Unlike the industrial revolution, the developing countries present potential for leapfrogging in the applications of ICTs. These developments dictate, for all countries, a major agenda of structural adjustment and change in the style of management, control and governance. Advanced countries are rapidly pursuing their version of the agenda, and developing countries like India must do so at the earliest, or risk their exclusion from a global economy and severe disadvantage in the competitiveness of their goods and services in the international market.

The World Development Report for 1998 has most appropriately focused on 'Knowledge for Development' (World Bank, 1998). The report highlights various attributes of knowledge that differentiate the developing countries from the developed. The report highlights that acquiring knowledge is as important as its absorption and communication. It also shows the widening disparities between the developed and developing countries as far as the development and application of ICTs is concerned. Estimates have shown that in 1993 there were

² Raza Moonis and Aggarwal Yash (1983), *Transport Geography of India: An Analysis of Commodity Flows and the Regional Structure of the Indian Economy*, New Concept Publishers, New Delhi.

³ Information and Communication Technologies (ICTs) encompass all those technologies that enable the handling of information and facilitate different forms of communication among human beings, between human and electronic systems, and among electronic systems. Today the common feature of these technologies is digitisation.

approximately 173 million computers in the world and nearly 43 percent of these computers were being in use in USA alone. Another 40 percent of computers were used in the other 17 large industrialised and developed countries such as Japan, Germany, UK and France. This leaves nearly one-sixth of the computers, in use in the remaining 200 countries of the world (Williams, 1998). The developing countries, therefore face an uphill task to develop and deploy the large scale IT applications in education, research and administration.

Education, as a producer of knowledge, is frontrunner and spearheading ICT related developments. The curriculum in developed countries, at all levels of education, has been redesigned and places greater emphasis on the use of ICTs. The educational systems of developing countries are still recovering from the shock waves of the ICT revolution that has already taken place in the developed world during the last two decades. Can the developing countries face the challenges which the last decade of the present millennium poses? These questions can not skip the attention of development planners in developing countries even with a vision of 3-5 years. The second role for the education sector is to use these technologies for improving its managerial efficiency and effectiveness. The education sector, perhaps the most mismanaged social sector, is characterised by managerial inefficiencies of high order. The present paper surveys the salient features of the IT policy in India and examines the important issues in its application in educational planning and management.

2. INDIAN EDUCATION: AT CROSSROADS

The Indian education system, even after 50 years of independence, continues to be largely colonial in character although the efforts to modernise, restructure and make it responsive to the emerging needs of the developing economy have succeeded to some extent. The country is still faced with the challenge of mass illiteracy and low quality of educational output at all levels. There are more than 300 million illiterate and about 60-80 million children of age less than 10 years do not attend school regularly. The quality of education, even at the primary stage, is below the prescribed standards and only a few students cross the threshold of prescribed competencies. The persistence of the colonial characteristics is clearly manifested in the present day inspection and supervision styles of school education. The bloated belly of higher education and persistence of amorphous arts and humanities sector is a matter of concern. There are few islands of excellence in the vast ocean of mediocrity. There is hardly any link between the curriculum and the requirements of the world of work. Improving the relevance and effectiveness of education is a major challenge facing the development planners.

The system of education as it has emerged in India is the most complex and one of the largest in the world. Presently, there are about 600,000 primary, 176,000 middle, 100,000 high and higher secondary schools in the country. The number of universities has increased to 229 and the number of arts, science and commerce colleges hovers around 7,000. The number of engineering and medical colleges is about 1100 and the polytechnics number more than 1000. The number of children studying in various classes at the school level is about 180 million. There are about 4.5 million teachers employed at various stages of the school level, most of

whom may be in 45+ age group⁴. While no reliable statistics are available, the number of educational administrators working at the district and the state level departments of education will be in thousands. The age profile of the educational administrators is on the higher side, as it takes about 20-30 years of active service before an officer is promoted as a District Education Officer.

The education sector thus not only acts as a trend setter for the social and economic development by producing the skilled manpower but also is the largest employer of educated and qualified manpower. What is being taught today in the institutions of higher education will be a major determinant of the productivity and quality of the workforce in the coming years. The persistence of illiteracy and low levels of educational attainment among the workers of 2020 will be a major curse for any country. With rapidly changing technology and ever increasing application of ICTs, the deskilling of labour force has already started. Next 10-20 years will be very crucial from this point of view.

Another important feature of the Indian education system is its spatial outreach. No other sector has such an extensive outreach as education has. The Indian network of educational infrastructure is perhaps the most complex in the world. The nodes range from a small school without adequate instructional materials and buildings, located in the remotest and inaccessible corner of the country to that of the most advanced schools well equipped with the latest equipment and facilities.

While decentralisation is being pursued vigorously at all levels of educational administration, the system is characterised by management inefficiencies and lack of effective co-ordination at various levels as far as planning and management of education is concerned. Decentralisation requires efficient and effective information/data base for micro-level educational planning, which is yet to be evolved for a large number of districts in the country⁵. The responsibility for the planning and management for elementary education is being transferred to thousands of VEC, whose members may have little experience in governance. The school infrastructure and facilities are in deplorable condition and access to primary education is an issue for the children living in smaller and isolated habitations. Although the administrative hierarchy varies from state to state, the complexities of the decision making process result in inordinate delays and administrative bottlenecks. Planners and administrators loose interest in many reforms/schemes due to poor monitoring and evaluation mechanisms⁶.

Traditionally, educational reforms are implemented slowly in the Indian context. One of the reasons for the persistence of many ills is that the reforms were either missing or the pace has been so slow that the gains were minuscule as compared to the problems related access,

⁴ MHRD (1998), *Selected Educational Statistics 1997-98*, Department of Education, MHRD, New Delhi.

⁵ Most of the efforts undertaken by the MHRD in this regard could not be sustained. The DPEP has implemented an information system designed and developed by NIEPA (Project DISE).

⁶ For a review of the progress and promises in education, please see the annual reports of the MHRD.

retention and quality of education. The country is still far away from achieving the promises of universal literacy and education for all children in 6-14 years age group-a promise that was made to the nation in its constitution. Vocationalisation and diversification at +2 stage is moving at snails pace (MHRD, 1998). The planning and management capacity of the country is weak with little scope for regular in-service training for educational administrators. While NIEPA is the only resource institution at the national level with limited outreach, the state level structures have failed to emerge. The DIETs, which were established after the NPE, 1986 have been slow to respond to the key tasks assigned to them. More than 400 DIETs have already been established, one in each district. Their contribution for the promotion of planned educational development at the district level is meagre.

The introduction of ICTs during the 1970s, in the form of telephone, educational television and satellite communication began to show specific patterns of social benefits in developing countries. In the Indian context, the application of technology in education was recognised as a potential area to improve access and quality of education. India has a long history of the use of radio for instructional purposes. Similarly, the use of TV for instructional purposes was taken up on a large scale in India. The progress of various efforts to use educational technology for instructional purposes has been uneven across various levels of education as well as for different regions of the country (MHRD, 1992). IGNOU now runs one of the largest open education systems in the world and uses the ICTs in a big way.

There is still a class of educational administrators practically at all levels of educational hierarchy, who have not adapted themselves to gain from the new technological revolution. They feel that their existing approach is better and more reliable than the use of modern technology. Some even feel vulnerable when it comes to the application of modern technologies in administration. Where is the problem? Is it with the technology or with the user? What can be done to prevent some of these problems? Can a time bound framework be evolved for the adoption of new technology in management? The government departments have to play a critical role in this context. Each department should evolve a plan for this transformation. The NIC should have helped the government departments to move in this direction, but in reality most departments do not have a perspective plan for the introduction of ICTs. Can the ICT be used to improve the existing situation? Can it lead to better and cost-effective administration and delivery of educational services? While the questions related to the curriculum, its relevance and effectiveness are important for improving the quality of education, these have not been addressed in the present paper.

It must be recognised that the informal sector has played a very vital role in the development of IT education and training in India. One could even go the extent of saying that the present supremacy of the Indian IT education and training sector is largely due to the active role played by the private sector in the last two decades. Organisations like NIIT, Aptech, STG, Pentafour, now train world class IT professionals from India and abroad and their number runs into hundreds of thousands per year. No Indian or foreign university can compete with such organisations in terms of organisational skills, professional competencies, students enrolment and the commercial nature of their activities. Hundreds of capitation fee charging colleges in Maharashtra, Tamil Nadu and Karnataka have produced large numbers of

engineering and computer professionals who now man the vital installations in ICT sector and mission control applications across the world. Thousands of small computer training centres in the informal sector have sprung in various parts of the country, many in rural areas, and their contribution is immense to the ongoing transformation in the IT sector in India. Programmes offered often include computer appreciation courses, word processing, use of spreadsheets and common purpose software applications. The trainees come from every stream of the society and many of them end up working for the multinationals in India and abroad. There are no estimates of the manpower employed and the number of beneficiaries from such courses. It is only now that the government of India has woken up to this reality and is developing a national policy for IT in India. It is strongly suggested that the government should not interfere too much with the informal education and training in IT. It should rather focus on the use of IT professional manpower for improving its efficiency and effectiveness of administration, co-ordination, governance and decision making, which is not a small task in a country of the size and complexity of India. Such a strategy will not only lead to improvements in the quality of governance, but also support the vast informal sector in its growth.

3. ICT POLICY IN INDIA

During 1960s and 1970s, the developing countries received technical assistance from developed countries for improving their technological base. Considerable assistance was available for the purchase of foreign manufactured hardware. Various studies showed that the primary beneficiaries were the foreign companies that provided the equipment. This gave rise to a debate within the UNESCO and the United Nations General Assembly about the efficacy of foreign technology. Considerable thought was also given to the need to maintain balance between technical assistance and the human resource development to use these technologies. Eventually a New Information and Communication Order was formulated which provided the framework for the development of ICTs in developing countries. Following this and related developments, in 1980 the UNESCO General Conference initiated the international program for the development of communication.

In India, the Department of Electronics (DOE) is the primary agency overseeing government IT policy formulation and implementation. Three government-funded computing organisations play important roles in new technology development: the National Centre for Science and Technology (NCST) in Bombay, the Centre for Development of Advanced Computing (C-DAC) in Pune, and the National Informatics Centre (NIC) headquartered in New Delhi. C-DAC is now one of the most advanced IT development centres in India. The NIC was the second major Indian computer-related project funded by the UNDP in 1977. It operates the largest data communications network (NICNET) in India with more than 600 earth stations linking government agencies at all levels. There are many lessons to be learnt from the two decades of NIC operations in the country. NIC has done a pioneering work in popularising the use of computers in the government sector, breaking the geographical boundaries and encompassing all sectors of economic activity. In the process, it has carved out a niche for itself among the public sector organisations. There has not been enough

emphasis on capacity building of the users but it has taken upon itself the job of creation of IT applications for different government departments.

Any government will have a dual role in the ICT sector and India is no exception. It acts as a regulator and formulates long term policies for the promotion and development of various industrial and service sector reforms including the ICT related activities; and at the same time, it deploys these services for the governance and improving the efficiency of its decision making and administrative control. The government's reform agenda is also affected by bilateral and multilateral agreements. This is particularly true of the ICT because of its international outreach and impact. The recent advances in ICT will have a profound impact on the way the governments function in the coming years. While the move towards decentralised planning and management will gain momentum, the need for high quality of information for decision making, control, monitoring and evaluation will increase in all sectors of social and economic activity. To what extent the Government of India can benefit from the development and application of emerging technologies for information storage, processing and communications? What has the Government of India done in this context? Has it kept pace with global trends in ICT and to what extent it has been active in policy formulation? Has it been an effective user of ICT in its day-to-day administration and decision making? These are some of the questions, the answers to which are difficult to get.

India is in a relatively better position as compared to many South Asian/SAARC countries with regard to the development and applications of ICTs (Table 1). Nevertheless, there are large imbalances in the development and use of ICTs within the country. China, which has a larger population base than India, has better availability of ICTs. Sri Lanka stand out clearly as compared to other countries of the region. The high level of socio-economic development are associated with the high availability of ICTs. The WDR has also shown that there is a positive relationship between literacy and the application of ICTs for development purposes.

Table 1: Availability of ICTs in selected countries (per thousand persons), 1996

Country/region	Radio	TV	Telephone	Mobile	Personal Computers	Internet Users
India	105	64	15	0	1.5	0.05
Pakistan	-	24	18	0	1.2	0.07
Nepal	57	4	5	-	-	0.07
Bangladesh	48	7	3	0	-	0
Sri Lanka	195	82	14	4	3.3	0.33
China	161	252	45	6	3.0	0.21
High Income countries	-	-	546		199.0	111.00
World	-	211	133	28	50.0	34.75

Source: World Development Report, 1998/99.

The gap in the availability of ICTs in developing countries in the South Asia and the developed world is extremely high and so is the situation within the developing countries. For example, India will require 15 million additional PCs even to reach the level of the neighbouring Sri Lanka.

1990-91 was a watershed year in economic development planning in India. The country embarked upon a structural adjustment reforms programmes and opening up of the economy

after having faced serious economic and balance of payment crisis as a result of its socialist leaning. Besides other sectors, reforms in infrastructure including telecommunication sector were accorded high priority. The Government of India announced a Telecom Policy in 1994 which provided for large scale opening up of the telecommunication services to the private sector. The outcome has been spectacular in terms of the availability of telephone facilities in the rural areas, although there are miles to go before the benefits of modern communication technologies reach the consumers in far off places. Satellites and telephone lines are the essential medium of communication for using Internet and other type of ICTs.

Information technology and related activities did not attract enough attention of the Government of India even after the structural reforms were initiated in early 1990s. The Internet was introduced in the country in 1995 on a modest scale through a single organisation over which the government has complete monopoly⁷. The NIC pursued its own agenda of enclavisation during the eighties and nineties. It was only in March, 1998 that the National Agenda for Governance (NAG) of the new government highlighted the need for an integrated policy framework for the development of IT in India and making India a global power in software development. A national level taskforce was subsequently appointed to suggest the strategies within a time bound framework. The taskforce submitted an Action Plan containing 108 action points to the Government of India. The taskforce recommended a three fold strategy with a focus on:

- i) Accelerated efforts to establish a world class ICT Infrastructure in India;
- ii) Thrust on IT exports so that India emerges as a true leader in software development and related areas;
- iii) IT for all by 2008: Accelerate the rate of PC penetration by ten fold of the present availability alongwith a universal access to Internet, extranet and Intranet by the year 2008. The taskforce suggested 'OPERATION KNOWLEDGE' as a proactive drive to universalise computer literacy and also to spread the use of computers and IT in education.

The recommendations 58 to 71 of the Action Plan deal with the above concerns. The proposed initiatives though laudable, should be seen in the context of other similar commitments, especially those having bearing on educational planning and management. The agenda for the next few years for the government will be as under:

- Education for All (6-14 years age group children)
- Health for All
- Literacy for All
- Universal Computer Literacy by 2008.
- IT for All

In addition to the above declarations, the government is also faced with a daunting task of reducing poverty, achieving conditions of full employment and reduction of regional and

⁷ The government recently announced the grant of licences to few new ISPs.

social imbalances in various development indicators including the use of ICTs. Considering the difficult circumstances through which the Indian economy is passing, finding financial and manpower resources to fulfil the above objectives will be a daunting task and require commitment from the highest quarters of the government.

The IT for All will require much higher level of availability of ICTs that what is available now. Even if we assume that all college students will have access to Internet and a PC in their college, an investment of billions of rupees will be required. It also raises the questions related to the efficiency and effectiveness of the investment. Equipping secondary and senior secondary schools with PCs will mean additional 1 million computers costing about Rs. 6,000 crores or US\$ 1.5 billion (an average of 10 PCs per school). This amount is nearly half of the expenditure on secondary education of the central and state governments in 1996-97 (MHRD, 1998a). The cost of application software development, deployment and supplies will be additional. This is only to illustrate the immensity of the tasks involved. On the other hand are the issues related to the use of existing ICTs, especially in education and training sector.

In India, there are some states like Andhra Pradesh, Maharashtra, Tamil Nadu, Karnataka and Delhi which have taken a lead for the development and promotion of ICTs in education, training and public administration. These are already developed states and way ahead of some of the economically backward states. But what will happen to industrially and economically backward states? These are the states where development issues are of greater significance. How can technology lead to development with equity and social justice. What can the technology contribute in areas where the administration is corrupt, biased and most of the institutional structures are dys-functional? The gap between the rich and the poor states is likely to further accentuate as far as development and use of ICTs is concerned. What is the government's policy in this context? To what extent the inter-state and intra-state disparities in access and use of ICTs will be desirable in the Indian context? It is good to set objectives covering the whole population. Experience so far shows that none of these objectives has ever been achieved in the last five decades of development planning. The IT taskforce has not looked into these vital questions. Many of these issues are of national concern and a clear perspective is needed as far as the role of government is concerned.

In terms of the application of ICT in government decision-making, it is important to distinguish between the hardware and software proliferation. The governments often face the following issues as far as the application of ICT is concerned:

- a) Identification of the areas of ICT application.
- b) The co-operation and sharing in the collection, analysis and use of information between various government departments.
- c) Choices of appropriate technology i.e. the hardware to meet the above objectives.
- d) Development of sector specific software application packages.
- e) Capacity building and developing a reflective attitude for the IT.
- f) Integrity and safety of the data collection, storage and dissemination is an important issue for governance. Security and data protection protocols are essential for some of the government departments.

- g) Information overload: the amount of information that is collected is increasing at an exponential rate with considerable redundancy. Even with the application of ICTs, searching for relevant information from thousands of sources can be a headache for most end users.
- h) Acceptance under law: Electronic records are still not accepted under law in India. The recent move to develop a cyber law in India shows the urgency.

4. WIDENING GAP BETWEEN COMPUTING POWER AND ITS USE

Over the years, there has been a tremendous increase in the computing power of even the personal computers. Today's PCs have the computing power that is far more than what was available with the mainframe computers in sixties and early seventies. A negative relationship between the computing power and the cost of hardware can be moulded to the user's advantage by extensive use of the hardware and its computing power. This factor often allows the new entrants to leapfrog in the use of technology but requires extensive efforts at capacity building and user orientation in the use of the new technologies. It is ironical that in the name of modernisation, computers have found entry into the chambers of most of the decision-makers and many of these machines are gathering dust? What are the reasons for this? Is there no appreciation of the technology or something else is missing? It is felt that while constraints regarding the availability of hardware have been removed, the software and capacity building related problems still persist. There is a widening gap between the computing power that is available and its use in DSS in educational management? Do we have the appropriate software to support decision-making at various levels. Are appropriate types of software available for decision making in education? Perhaps not? Who is to develop and maintain software related activities in education? Is there any policy on these issues within the central or the state departments of education? The answer is again- perhaps not?

5. INFORMATION NEEDS FOR EPM

Generally the information needs of educational administrators can be classified as:

- a. Information for strategic planning (forecast reports)
- b. Information for management control (analytical reports)
- c. Information for operational control (operating reports)

In the past few years, OR has made significant contributions to educational administration through innovative applications at the operational level.

Resource allocation:

In order to achieve its mission and aims, the university administration must be successfully and prudently allocate its resources, both physical and human. A mean to this end is provided by using Goal Programming model (GP).

5. RECORDS MANAGEMENT AND DSS

Historically, the system of governance is based on sound record keeping so that irrespective of the executive head, the records forms the basis for governance, control and decision making. Each country has evolved legal basis for the maintenance of records and transaction processing. Billions of pages of information are being generated each year by various departments of the central and the state governments in India⁸. Some of this is in the duplicate and triplicate form. Even then the relevant information is difficult to locate from the existing records and sharing of information between departments is non-existent. Seen in this context, the central and state governments are perhaps the largest repositories of information that is collected to meet the statutory requirements, information for decision making, control and governance. How to store, manage and retrieve government information in an efficient manner? It is in this context that the management of large volumes of data using ICTs makes a good sense. The storage of this information using large capacity storage devices can reduce the need of storage space by a factor of at least one ten thousandth. Consider the access and retrieval time, the savings in terms of time and money could be enormous. Look at the maintenance cost of office records for 10-15 years-the average life span of a data in the public sector. The trade-off from the application of high storage and retrieval devices are thus enormous as compared to the manual systems. Why are governments responding slowly despite the immense benefits from the application of IT for storage, retrieval and maintenance of office records? Has the government thought about this aspect? The recent initiatives of the state government of Andhra Pradesh are best illustrations of this. The state has embarked upon large-scale computerisation of government records that have a strong public interface although some legal and security related problems are yet to be resolved.

The proliferation of ICT in governance and decision making can be assessed through a number of indicators. The most important indicators suggested for this purpose relate to i) the availability of computers per thousand employees in the public sector; and ii) the ratio of computers with management related activities to total computers in the system. There are hardly any statistics about the availability and use of ICTs in India. Based on these indicators, the following scale can be used to assess the penetration of ICT in government and other sectors. Stages of the diffusion of technology in educational planning and management are:

- a) Non existent: A stage where there is no use of ICT in decision making at any level in the educational hierarchy. The use of ICTs may be confined to high level research and development activities in the universities and research institutions.
- b) Experimental stage: This stage highlights the beginning of the use of computers and associated software for decision support services. This is characterised by various type of pilot studies and experimentation with the development and implementation of application software specific to the needs of decision-makers. The successful completion of the experimental stage leads to the establishment of procedure for large scale replication of the ICT. There are number of applications which have been

⁸ It is estimated that on an average 200 tonnes of paper is used to collect data from schools in India. It is assumed that a school submits data worth about 25 sheets of paper every year. In actual practice, this is much more than 25 sheets.

experimented⁹. These include personnel management, salary disbursement, inventory control, fund-flows, text-book production and distribution, student records, examination results etc. Many schools and colleges have made some progress in such applications.

- c) Established use: When the experimental phase is over, the users are trained for large-scale application of ICT. This calls for periodic review and feedback and upgradation of the existing applications. In India, there is hardly any application that has been standardised at the state or the national level as far as educational management is concerned. The problems of parallel systems, lack of standardisation, multiplicity of data collection, overlapping systems need to be resolved before the large-scale application of ICTs gets established. In the context of decentralised management of education, the development and application of standardised systems is non-negotiable.
- d) Common use: This is the stage of maturation of the ICT applications. The best examples of this phase are the reservation system of the railways and airlines. Banking and insurance are the other areas where the use of ICT has reached a stage of widespread use. The use of Internet in distance teaching-learning are examples from the education sector. At this stage there is no parallel manual systems as backup support. There is hardly any application in educational management that has reached the stage of common use of ICTs.
- e) Sustainability: This is the stage that regenerates into higher levels of applications and characterises the sustainability of the ICT applications. The education sector is far away from the stage of reaching sustainability as far as the use of ICTs in educational management is concerned.

The above description of the stages of penetration of ICTs is illustrative and clearly shows that the use of ICTs in educational planning and management has not gone beyond the stage of experimentation. The sustainability stage is far off and will require clear policy perspective, changes in rules and regulations so as to remove the legal problems.

6. PERSONNEL MANAGEMENT

Education sector employs a large variety of educated manpower which includes teachers, educational administrators, planners, inspectors, subject specialists, statistical assistants, planning officers, clerks and other administrative staff. A variety of official records are maintained for all of them. The deployment and management of such a large force is a major activity within the departments. Even if the recruitment and deployment of teaching staff is undertaken at the district level, the standardised software can be developed for this purpose. The pension documents of teachers are not finalised even months after their superannuation. The service records for each employee are maintained for 35-40 years. These can be easily computerised and maintained in digital form alongwith the photographs and other data about

⁹ The recent efforts to establish database at district level (District Information System for Education) for the planning and management of District primary Education Programme is illustrative of the management related use of ICTs.

each teacher. Digital information could form an essential component of the service records and can be maintained at various levels.

7. NORM BASED PLANNING

Planning for education is essentially norm based. There are specified norms for opening of schools, teacher requirements, teacher transfers, school infrastructure, classrooms and teaching materials. Inventory of school buildings and their maintenance schedule is an important component of the school records. Access to these records is limited. Decentralised planning requires considerable information from other social and economic sectors, like population, health, employment, social welfare and tribal development agencies. In some areas, multiple agencies operate and run the educational institutions. In addition to government agencies, there are NGOs at the national and local level. The district has now emerged as the nodal point for educational planning as far as school education is concerned. In India, most of the universities are affiliating and provide development grants to colleges. There is no established information system for the higher education in India. It is unfortunate that the UGC has not as yet considered the use of ICTs in the management of higher education.

The establishment of District Institute of Education and Training (DIET) in most of the districts in the country is a step in the right direction. These are meant to provide professional and technical support for educational planning and management at the district level. In addition to other departments in the DIET, the Planning Unit having 2-3 staff members is expected to be nodal centre for such activities. A number of computers are also provided to each DIETs.

What has been the outcome of these efforts? Excepting a few, the DIETs have miserably failed to fulfil the expectations as far as the use of IT for supporting educational planning at the district level is concerned. There are DIETs where even the computers were not installed during the warranty period. There is no guidance to those institutions that have installed computers. How should these computers be used? What type of training in research methodology and computer applications will be required to optimally use the scarce resources? Discussions and field visits have shown that a great confusion continues about the use of computers in planning and management of education.

How can this situation be reversed? How can the DIETs be made to fulfil their role in the use of ICTs. This has also to be seen in the context of the role of the SCERTs. The SCERT, one in each state, acts a nodal agency for the development of DIETs. The SCERTs lack a clear direction and plan of action as far as the use ICT for educational management is concerned. How many SCERTs have developed the software for use in DIETs? The answer may be in negative from most of the institutions. The Department of Education, MHRD can not ignore this for a long time to come. A national master plan for the use of ICTs in educational management needs to be evolved and the MHRD will have to take a lead in this matter.

The use of local language in educational management is both desirable and a legal necessity. The computers working in most parts of the country still use English as the language of storage and communication. The R&D centres have to evolve technologies that will be able to

build the interface between the foreign and the local languages. The penetration of ICTs will considerably depend upon the ease with which such a transformation is made possible.

Geographic information can be very useful in integrating, modelling, analysing, and visualising different types of educational data. Geographic information can be of strategic advantage for a number of applications, including spatial planning, command and control systems, micro-planning, distribution of books and teaching learning materials. Individual states have also set up agencies like the AP State Remote Sensing Applications Centre, which is engaged in the development of digitised base maps. There is no common standard for reference systems, scales, degrees of accuracy, formats and data structures for developing base maps across the states. It would be useful to define the standards for such parameters at an all India level.

8. CAPACITY BUILDING

Capacity building of educational planners and administrators is a continuous process. The research in training strategies suggests that a continuous and comprehensive training is much more effective than modular face to face training for a short span of time, may be once in two/three years. Normally the trainers and subject specialists are far lesser than the requirements to fully train the concerned manpower. In India, there are more than 4.5 million teachers working at various levels. How to ensure that besides the general training module, each teacher is trained in the specialised areas of pedagogy and institutional planning on a continuous basis. Similarly, there are about half a million VECs in the country. Each VEC consists of about 10 members giving a total of 5 million members of the VECs. Their training in critical areas of educational management is necessary. The following table summarises the approximate number of educational administrators at various levels:

Table 2: Approximate number of educational administrators in India

Sr.	Category	Approximate number
1	Directors of Education at the state headquarters	150
2	State Directorate Staff connected with planning and management of education	600
3	University Vice Chancellors, Registrars, Financial Controllers, Deputy Registrars and other senior level administrators	2,000
4	College Principals/Vice principals of general and professional colleges	15,000
5	Principals of high and senior secondary schools	1,00,000
6	Principals of primary and middle schools	7,50,000
7	Professional and technical staff in DIETs, state directorates and other institutions	4,00
8	District Education Officer and equivalent grade education officers at the district level	2,000
9	Block/area education officers and equivalent cadres	10,000

The above is only illustrative of the magnitude of the task involved in the capacity building of educational administrators. Even a large network of institutions will not be in a position to provide face to face contact for every trainee even for a few days with a training cycle of 3-5 years. At present, there is no regular system of training for educational administrators

especially in the context of the use of ICTs¹⁰. There is a need to establish a specialised institution for the development of application software for these institutions. Areas for application software include a model of institutional planning, micro-planning using norm based algorithm, projection techniques, inventory management, teachers database and personnel management, monitoring of incentive schemes and a model of district planning for school education etc. Project management is another area that requires serious attention of development planners. In India, there is hardly any monitoring system for the Centrally Sponsored Schemes that invest billion of dollars in educational enterprises across the country. The whole budgetary system can be redesigned using ICTs to provide the latest financial position and improve the efficiency of financial management at the central and the state level. Implementation of such systems on large scale will not only require the development and deployment of financial packages but also calls for a change in the rules and regulations governing financial transactions.

Internet is another promising area, the benefits of which can be tapped to promote the norm based planning. Information technology offers vast possibilities in the gathering, editing, publishing and distribution of information in an electronic format as well as new possibilities for electronic commerce using communication technologies.

Using Internet, information can be accessed from almost anywhere. Vast amounts of training materials can be uploaded and retrieved with great ease. Internet offers the following advantages as compared to any other mode of accessing information:

- Updating of information is faster and easier than before. Latest advances in pedagogy and management can be easily shared with a large number of administrators while on job. Specialised training can be arranged as and when needed.
- The user-groups and discussion forums can be evolved for opinion polls, suggestions, views and feedback on critical issues of educational planning and management. Model institutional plans and innovative applications can be shared through the use of Internet facilities.
- Information can be made more accessible by providing the user with search facilities, i.e., searches by words or categories. the research findings and lessons learnt can be disseminated at a very low cost.
- Appropriate interfaces make information retrieval much more user-friendly than before.
- Communications between trainees and their teachers can be made easier. The use of video-conferencing can be made to promote interaction between the experts and the trainees from different geographical locations.
- The procedures for adaptation of standard applications to the local languages needs to be examined in detail. Otherwise, there might be a danger that the same information

¹⁰ In the recent years, NIEPA started training of educational administrators in the use of ICTs in educational management. However, the intake is not more than 50 persons per year. The states have also organised training for some staff in these areas, but their number are very much limited.

may be collected by different departments of the central and the state governments or by the different executive departments within the state.

The use of Internet for capacity building and training needs assessment is ideal for national and state level organisations like NCERT, NIEPA and SCERTs. It is unfortunate that all these institutions continue to follow the traditional face to face interaction without ever exploring the possibility of supplementing it with web based learning materials. Considering the demand and supply factors discussed above, it will not be difficult to conclude that each administrator may be able to get even a single chance during their career for training in the use of ICTs. Is that sufficient? How to overcome this situation? Some of the important areas for training of middle and senior educational administrators include project management, office records management, skills for quantitative and qualitative analysis using computers, management of technology, management of change and team work. At the lowest end skill levels could include basic awareness and understanding of the uses and applications of information technology. At the next level, use of office automation software and off the shelf software packages such as email, word processors and spreadsheets, could be taken up. IT managers, systems administrators and maintenance staff will require detailed operational training programmes.

9. PROMOTE COMPUTER LITERACY AMONG ADMINISTRATORS

Computer literacy is an important cornerstone of the information society. The IT taskforce (1998) has therefore proposed that all students should be trained in the use of information technology. To achieve this objective, the IT taskforce has suggested that educational system should be supported with ample resources. This policy, which also includes an assurance of life-long education and training, is deemed necessary to guarantee equal access to government information and supports the government's position that all citizens should have equal access to services. Main goals of ICT in educational planning and management in India can be defined as:

- Become personal computer users;
- Be able to use ICT in educational planning and administration;
- Be able to use ICT in education and training
- Develop reflective attitudes on the use of ICT in education;
- Be able to make use of ICT in personal competence development.

In this context, the Internet can provide access to educational networks and other learning materials. It is also important that the teachers, both at the school as well as in institutes of higher learning, are fully aware of the possibilities of using IT in teaching, research and management of their institutions. The use of IT in these areas should now become an integral part of their education and in-service and pre-service training.

There are a number of international projects relating to electronic government that are currently being piloted or implemented. Examples of international organizations include the International Council for the use of IT in Government Administration (ICA), the

Commonwealth Network of IT for Development (COMNET-IT), the OECD, the Asia Pacific Information Infrastructure initiatives and the Global Information Infrastructure Commission (GIIC). It would be useful for India to participate in international projects so as to both learn from experiences of others, as also contribute to the global experience in planning and implementing Information Technology projects, some of which are listed below.

- Directory Services led by Canada
- Reuse of Government information within national boundaries led by the UK
- Developing 'single window' concept of governance led by the US
- Improving customer service with kiosk technology led by the US
- Issue of permits and licenses led by Japan
- Delivery of government information electronically led by the UK
- Locating government information electronically led by the UK
- Charging for services led by Israel
- On-line formal transactions led by the UK
- Compendium of government on line activities and interests led by Canada

The use of ICTs and norm based planning requires the availability of a disciplined and skilled workforce. The ICT applications will fail to deliver the desired results when the custodians of information act like lords and fail to follow the prescribed procedures. The computer frauds and manipulation of databases for personal gains are not impossible. The hackers can create havoc with the network systems, just for their personal satisfaction. The ill-managed computer systems can be far more dangerous and vulnerable to the external intrusions. The ICTs will fail miserably when the rules are exceptions and decisions are a matter of discretion. It is therefore, imperative that the high quality of administration is a pre-requisite for the application of ICTs. The IT taskforce has yet to address these questions. The skill formation and renewal of IT related skills will be a major challenge for the development planners in the coming years.

10. PUBLIC DOMAIN INFORMATION MANAGEMENT

Since the future will witness large-scale integration of a wide range of applications both within and outside government, each country needs to initiate standardisation of basic data. It is necessary to recognise the strategic nature of ICTs in Government and to ensure consistency, connectivity and inter-operability. Mostly, the data capture formats are designed in an ad-hoc manner. A data item like teacher's name and address is captured by a host of sections within the education department. Such non-standardisation makes it difficult to integrate and co-ordinate usage of data by different sections and agencies, though the same data item may be required for multiple government services like service records, teacher training, teachers deployment, transfer and salary billing. Standards can help create predictable architecture ensuring the manageability, portability and interoperability of systems but there are miles to go before such integration is practised.

Meeting public access requests is an important function of any government office. The departments have formulated host of acts, laws, rules, regulations, guidelines, procedures and

applications forms for various services. Mostly, the users have to spend great deal of time and energy to have access to this information. The Internet provides an inexpensive medium to provide wider access to all type of documents and forms. Many government departments in India have already undertaken some steps in this direction, but the department of education is yet to evolve a strategy in this direction.

ICTs can make governments more efficient, accountable, and transparent. Large productivity increases in government services are possible with information systems that simultaneously increase speed, volume, quality, transparency, and accountability of transactions. Well-designed information systems can become major instruments of public policy - powerful tools to implement, enforce, and evaluate policy reforms. The students seeking admission to various institutions spend thousands of rupees in obtaining prospectus, application forms, admission information and examination results. A systematically designed database can make it very simple. The publication of examination results is another area where the students face considerable harassment.

11. INFORMATION OVERLOAD AND PRIVACY ISSUES

The Internet has become fertile ground for commentators and visionaries with fertile imaginations. It will do much to bring about world peace and harmony; or it will greatly expand global commerce; or it will be the locus of forms of information warfare from which nobody who is anybody can be safe; or it will bring about the end of the sovereign state. All this, and much more, is here or on the way via the Internet and no answers are available at this stage.

Some areas of concern in the use of ICTs have already emerged. One of the serious problems in the new electronic era is information overload. Finding relevant information, particularly news, amongst thousands of integrated computers can be difficult and time consuming. Since news articles are broadcast in topic based newsgroups, authors have a single global topic based place to collaboratively post information.

At the same time, issues of accessibility, intellectual property protection, fair competition, content regulation, and cultural preservation arise, and they are far from being resolved. How to ensure that ICTs services are available to all citizens and not just to the technology-literate? The government has perhaps the most compelling reason for assuring that new technologies do not become a barrier between government and the citizens. Automating internal communications and processes is quite different from automating the interface between government and the citizens.

The foregoing discussion clearly illustrates the vast potential that the ICTs hold for development planners, especially for those engaged in educational planning and management. While India, alongwith many other developing countries is playing a prominent role in the development of application software, there is a need to restructure the education and training sector so that it not acts as a producer of technical and professional manpower, but also uses these technologies for improving its administrative efficiency and effectiveness. Although India missed the Industrial revolution, it has the potential of reaping the full benefits of ICTs

through a long-term vision of economic development in general and that of education and training in particular.

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